

Fixed-nitrogen and atmospheric N₂ contribution to biological productivity along a North-South transect in the Eastern Atlantic Ocean

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Marine primary production is limited by nitrogen availability over large areas of the world's ocean but especially in tropical and subtropical waters [Moore et al., 2009]. Nitrogen thus plays a critical role in the sequestration of atmospheric carbon into the deep ocean via the biological pump [Sohm et al., 2011]. The fixed-nitrogen budget in oceanic systems presently indicates that sources and sinks for nitrogen are not balanced. Biological nitrogen fixation provides the largest input of nitrogen to the oceans [Codispoti, 2007], while its removal through sediment and water column denitrification and anaerobic ammonium oxidation represents the loss function. The latter is generally considered to exceed the input via N₂ fixation [Codispoti, 2007]. The past few years this condition has triggered several studies into the importance of N₂ fixation as a source of new nitrogen to the ocean. We seized the opportunity offered by a scheduled north-south cross-Atlantic expedition to investigate the contributions of different N-nutrients (fixed nitrogen and atmospheric N₂) to the biological production process and their variability between the different oceanographic provinces crossed.

The EUROPA cruise (European Universities & Research On board Polarstern in the Atlantic; [Auel et al., 2012]) took place on board R/V Polarstern sailing from Bremerhaven (Germany) to Cape Town (South Africa, ANT XXIX/1; Oct.-Nov. 2012). The cruise section followed the NW African coast, possibly affected by Saharan dust input, and crossed the area of marked nutrient doming (centered on the equator) and O₂ depletion (on both sides of the equator) between 20°N and 20°S. At 17 stations, between 37.83°N and 26.26°S, we sampled the upper 700m of water column for nutrient distributions (ammonium, nitrate, phosphate) and for the natural isotopic composition of nitrate ($\delta^{15}\text{N}$ and $\delta^{18}\text{O}$) to trace the major biological transformations of the nitrate pool, including N₂-fixation [Großkopf et al., 2012]. We also conducted incubation experiments, using stable isotope enrichment techniques (¹⁵N₂; ¹⁵NO₃⁻; ¹⁵NH₄⁺; H¹³CO₃⁻), for assessing primary production (PP) and the contribution of different N-sources, including atmospheric N₂, NO₃⁻, and NH₄⁺, to the PP process over the euphotic layer (surface to 0.5 % PAR depth level). Shipboard data and first results of the enrichment experiments will be discussed.

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